



Standard Specification for Anaerobic Single-Component Adhesives (AN)¹

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1. Scope

1.1 This specification covers single-component anaerobic adhesives suitable for locking, sealing, and retaining threaded or cylindrical assemblies. The adhesives are cured to a solid state when confined between closely fitting active metal surfaces.

1.2 This specification is intended to be a means of classifying anaerobic adhesives. It is not intended for engineering design purposes.

1.3 This specification is intended to replace Military Specifications MIL-S-22473, MIL-S-46163, and MIL-R-46082.

1.4 The values stated in SI units are to be regarded as the standard.

1.5 The following safety hazards caveat pertains only to the test methods portion, Section 7, of this specification. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- A 109 Specification for Steel, Strip, Carbon, Cold-Rolled²
- B 36/B 36M Specification for Brass Plate, Sheet, Strip, and Rolled Bar³
- B 209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate⁴
- B 633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel⁵
- D 56 Test Method for Flash Point by Tag Closed Tester⁶
- D 439 Specification for Automotive Gasoline⁷
- D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)⁶

- D 770 Specification for Isopropyl Alcohol⁸
- D 907 Terminology of Adhesives⁹
- D 1084 Test Methods for Viscosity of Adhesives⁹
- D 1193 Specification for Reagent Water¹⁰
- D 2693 Specification for Ethylene Glycol⁸
- D 3951 Practice for Commercial Packaging¹¹
- D 4562 Test Method for Shear Strength of Adhesives Using Pin and Collar Specimen⁹
- D 4800 Guide for Classifying and Specifying Adhesives⁹
- D 5648 Test Method for Torque-Tension Relationship of Adhesives Used on Threaded Fasteners (Lubricity)⁹
- D 5649 Test Method for Torque Strength of Adhesives Used on Threaded Fasteners⁹
- D 5657 Test Method for Fluid Tightness Ability of Adhesives Used on Threaded Fasteners⁹
- E 122 Practice for Choice of Sample Size to Estimate a Measure of Quality for a Lot or Process¹²

2.2 Military Standards:

- MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes¹³
- MIL-STD-129 Marking for Shipment and Storage¹³
- MIL-STD-810 Environmental Test Methods and Engineering Guides¹³
- MIL-STD-118 Commercial Packaging of Supplies and Equipment¹³

2.3 Federal Standards:

- FED-STD-313 Material Safety Data Sheets, Preparation and Submission of¹³

2.4 Federal Specifications:

- FF-N-836 Nut: Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding and Single Ball Seat¹³
- PPP-B-636 Box, Shipping, Fiberboard¹³
- QQ-P-416 Plating, Cadmium, Electrodeposited¹³

2.5 Military Specifications:

- MIL-R-46082 Retaining Compounds, Single-Component, Anaerobic¹³
- MIL-S-22473 Sealing, Locking, Retaining Compounds; Single-Component¹³

¹ This specification is under the jurisdiction of ASTM Committee D-14 on Adhesives and is the direct responsibility of Subcommittee D14.60 on Adhesive Material Classification System.

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² Annual Book of ASTM Standards, Vol 01.03.

³ Annual Book of ASTM Standards, Vol 02.01.

⁴ Annual Book of ASTM Standards, Vol 02.02.

⁵ Annual Book of ASTM Standards, Vol 02.05.

⁶ Annual Book of ASTM Standards, Vol 05.01.

⁷ Discontinued—See 1991 Annual Book of ASTM Standards, Vol 05.01.

⁸ Annual Book of ASTM Standards, Vol 06.04.

⁹ Annual Book of ASTM Standards, Vol 15.06.

¹⁰ Annual Book of ASTM Standards, Vol 11.01.

¹¹ Annual Book of ASTM Standards, Vol 15.09.

¹² Annual Book of ASTM Standards, Vol 14.02.

¹³ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

 **D 5363**

MIL-S-46163 Sealing, Lubricating, and Wicking Compounds: Thread-Locking, Anaerobic, Single-Component¹³
MIL-T-5624 Turbine Fuel, Aviation, Grades JP-4 and JP-5¹³

2.6 *U.S. Department of Transportation (DOT):*

Code of Federal Regulations, Parts 100 to 199, Department of Transportation Rules and Regulations for the Transportation of Explosives and Other Dangerous Articles¹⁴

2.7 *Society of Automotive Engineers:*

SAE J311 Fluid for Passenger Care Type Automatic Transmissions, Information Report¹⁵

SAE J429 Mechanical and Material Requirements for Externally Threaded Fasteners¹⁵

SAE AMS 2629 Jet Reference Fuel¹⁵

3. Terminology

3.1 *Definitions*—Some terms in this specification are defined in Terminology D 907.

3.1.1 *active metal surface, n*—relative to anaerobic adhesives, a metal surface that initiates the formation of free radicals within anaerobic adhesives.

3.1.2 *anaerobic adhesive, n*—an adhesive that is kept in the uncured state by oxygen, as in air, and that cures in the absence of oxygen when exposed to metal ions, especially copper or iron.

3.1.3 *Newtonian behavior, n*—the property of a liquid in which its viscosity is constant over a stated range of strain rates. (Compare *non-Newtonian behavior*.)

3.1.4 *non-Newtonian behavior, n*—the property of a liquid in which its viscosity is not constant over a stated range of strain rates. (Compare *Newtonian behavior*.)

3.1.5 *thixotropy, n*—in a liquid, the property of thinning when subjected to strains greater than the yield strain and of rethickening with time upon subsequent rest.

3.1.5.1 *Discussion*—The liquid must exhibit yield to be thixotropic. If the liquid is deformed more than the yield strain, the underlying elastic network is disrupted and its viscosity is reduced. The network reestablishes itself in time when at rest.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *breakaway torque*—the initial torque required to break the bond, measured at the first movement between the nut and the bolt, when unscrewing an unseated assembly.

3.2.2 *prevailing torque, n*—the torque measured at 180° rotation of the nut.

4. Classification

4.1 Anaerobic adhesives are classified into groups in accordance with their performance properties. These groups are subdivided into classes and grades, as shown in Table AN.

NOTE 1—For example, the designation AN 0411 would indicate:

AN	=	anaerobic adhesive (from Guide D 4800),
04 (Group)	=	retaining compound,
1 (Class)	=	low strength, and
1 (Grade)	=	viscosity of 100–500 mPa.

5. Requirements

5.1 *General Requirements*—General requirements are properties that are inherent in every lot of adhesive produced, but may be tested in accordance with Table AN at a frequency agreed on by the purchaser and the manufacturer in order to verify specification conformance.

5.1.1 *Ultraviolet Fluorescence*—The uncured adhesive shall fluoresce under ultraviolet illumination when tested in accordance with 7.1.

5.1.2 *Color and Workmanship*—The color supplied shall be the color for the given group, class, and grade, as specified in Table AN. The uncured adhesive shall be smooth and homogeneous after shaking, free from lumps, caked material, and particles of foreign matter when examined in accordance with 7.2.

5.1.3 *Flash Point*—The uncured adhesive shall have a flash point above 93°C when tested in accordance with 7.3.

5.1.4 *Storage Stability*—The strength shall conform to the properties specified for the given class in Table AN. The viscosity shall increase no more than 50 % above the uppermost limit for the given grade in Table AN when tested in accordance with 7.12.

5.1.5 *Toxicity*—The supplier shall furnish a Material Safety Data Sheet (MSDS) in accordance with FED-STD-313 so that the user can evaluate the safety of the material for the proposed use.

5.1.6 *Solvent Resistance*—The average strength of each adhesive, after solvent immersion testing in accordance with 7.11, shall meet the requirements specified for the given class in Table AN.

5.1.7 *Hot Strength*—The average strength of each adhesive, after hot-strength testing in accordance with 7.8, shall meet the requirements specified for the given class in Table AN.

5.1.8 *Heat Aging*—The average strength of each adhesive, after heat-aging testing in accordance with 7.9, shall meet the requirements specified for the given class in Table AN.

5.1.9 *Cold Strength*—The average strength of each adhesive, after cold-strength testing in accordance with 7.10, shall meet the requirements specified for the given class in Table AN.

¹⁴ Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

¹⁵ Available from Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.



TABLE AN Basic Properties—Anaerobic Adhesives
Group 1 Products

Group	Description	Class	Description	Grade	Color (5.1.2)	Strength at Standard Conditions, Prevailing Torque Strength (5.2.3.1), N·m	Viscosity (5.2.1), mPa·s	Solvent Resistance (5.1.6), Prevailing Torque, N·m, min	Hot Strength (5.1.7), Prevailing Torque, N·m, min	Heat Aging (5.1.8), Prevailing Torque, N·m, min	Cold Strength (5.1.9), Prevailing Torque, N·m, min	Speed of Cure (5.2.2), Prevailing Torque, N·m, min		
01	Threadlocking and retaining adhesives; slow curing; Newtonian flow properties	1		1	green	17.0–42.4	10–25	17.0	10.2 ^A	8.5 ^A	17.0	8.5		
				0										
		2				1	red	11.3–28.2	10–25	11.3	6.8 ^A	5.6 ^A	11.3	5.6
						2	orange	11.3–28.2	40–80	11.3	6.8 ^A	5.6 ^A	11.3	5.6
						3	red	11.3–28.2	100–250	11.3	6.8 ^B	5.6 ^A	11.3	5.6
						4	red	11.3–28.2	1000–10000	11.3	6.8 ^B	5.6 ^A	11.3	5.6
		3				1	yellow	7.9–19.8	100–200	7.9	4.7 ^B	3.9 ^A	7.9	3.9
						0								
		4				1	blue	4.5–11.3	10–25	4.5	2.7 ^A	2.3 ^A	4.5	2.3
						2	blue	4.5–11.3	100–250	4.5	2.7 ^B	2.3 ^A	4.5	2.3
						3	blue	4.5–11.3	1000–10000	4.5	2.7 ^A	2.3 ^A	4.5	2.3
		5				1	purple	2.3–5.6	10–25	2.3	1.3 ^A	1.1 ^A	2.3	1.1
						0	purple	2.3–5.6	100–250	2.3	1.3 ^B	1.1 ^A	2.3	1.1
6				1	brown	1.1–2.8	10–25	1.1	0.7 ^A	0.6 ^A	1.1	0.6		
				2	brown	1.1–2.8	100–250	1.1	0.7 ^B	0.6 ^A	1.1	0.6		
				3	brown	1.1–2.8	1000–10000	1.1	0.7 ^A	0.6 ^A	1.1	0.6		
7				1	yellow	0.8–1.5	100–250	0.8	0.4 ^A	0.4 ^A	0.8	0.4		
				0										
0			other	0										



TABLE AN Continued
Groups 2 and 3 Products

Group	Description	Class	Description	Grade	Color (5.1.2)	Strength at Standard Conditions, Torque (5.2.3.1), N·m				Viscosity (5.2.1), mPa·s	Solvent Resistance (5.1.6), N·m, min		Hot Strength (5.1.7), N·m, min ^A		Heat Aging (5.1.8), N·m, min ^A		Cold Strength (5.1.9), N·m, min					
						Steel		Plated			Break	Prevail	Break	Prevail	Break	Prevail	Break	Prevail	Break	Prevail	Break	Prevail
						Break	Prevail	Break	Prevail													
02	Threadlocking adhesives; fast curing; Newtonian flow properties	1		1	red	16.9–39.5	16.9–56.5	5.6–39.5	4.5–56.5	6000–8000	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4				
				0																		
		2		1	red	16.9–39.5	16.9–56.5	4.5–39.5	4.5–56.5	400–600	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4			
				0																		
		3		1	blue	11.3–22.6	5.6–17.0	3.4–22.6	2.3–22.6	110–150	5.6	2.8	5.6	2.8	5.6	2.8	5.6	2.8	5.6	2.8		
				0																		
4	wicking	1	blue	2.3–11.3	2.3–11.3	1.1–11.3	1.1–11.3	10–30	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1				
		0																				
5	wicking	1	blue	2.3–11.3	11.3–22.6	1.7–22.6	1.7–22.6	10–30	1.1	5.6	1.1	5.6	1.1	5.6	1.1	5.6	1.1	5.6				
		0																				
6	wicking	1	green	2.3–16.9	17.0–56.5	1.1–11.3	8.5–56.5	10–30	1.1	8.5	1.1	8.5	1.1	8.5	1.1	8.5	1.1	8.5				
		0																				
0	other	1	purple	3.4–11.3	1.1–11.3	1.1–11.3	0.6–11.3	at 2 rpm ≥ 5000 at 20 rpm 800–1600	1.7	0.5	1.7	0.5	1.7	0.5	1.7	0.5	1.7	0.5				
		0																				
03	Threadlocking adhesives; fast curing; thixotropic flow properties; lubricating	2		1	blue	7.9–22.6	2.3–22.6	1.1–22.6	0.6–22.6	at 2 rpm ≥ 5000 at 20 rpm 800–1600	3.9	1.1	3.9	1.1	3.9	1.1	3.9	1.1				
				0																		
3		3		1	red	11.3–28.2	11.3–33.9	5.6–28.2	5.6–28.2	at 2 rpm ≥ 5000 at 20 rpm 1200–2400	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6			
				0																		
0	other	0		1																		
				0																		